Original article

Effect of tamsulosin on lower urinary tract symptoms related to double-J ureteral stent: a randomised, double-blinded, placebo controlled trial

ABSTRACT

Objective To evaluate the effect of tamsulosin on stent-related symptoms in patients undergoing double-J ureteral stenting.

Methods and materials Seventy patients (47 men and 23 women; mean age 42.5 years) who underwent double-J stent placement in adjunct to urological surgery were prospectively randomised into two groups. Group 1 included 35 patients who received 0.4 mg of tamsulosin once daily for 4 weeks; group 2 included 35 patients who received a placebo for the same protocol. All patients were interviewed by the same physician about the frequency of stent-related symptoms at 4 weeks after stent insertion.

Results Patients in group 1 showed a lower score for suprapubic pain during the filling phase and lower pain during sexual activity than group 2, although the overall pain score was not significantly different between two groups. The mean urinary urgency score was less in group 1 in comparison to the placebo group (p=0.030). No statistically significant differences were found between two groups concerning haematuria, urinary incontinence, frequency nor dysuria.

Conclusion Tamsulosin improves symptoms associated with double-J ureteral stents, especially body pain during sexual activity.

Keywords Urethral stent, stent-related symptoms, lower urinary tract symptoms, tamsulosin, double-J

For referencing Guitynavard F et al. Effect of tamsulosin on lower urinary tract symptoms related to double-J ureteral stent: a randomised, double-blinded, placebo controlled trial. WCET® Journal 2019; 39(3):26-31

DOI https://doi.org/10.33235/wcet.39.3.26-31

Fateme Guitynavard
Urology Research Center, Tehran University of Medical Sciences, Tehran, Iran

Shahram Gooran
Urology Research Center, Tehran University of Medical Sciences, Tehran, Iran

Parvin Kasiri
Urology Research Center, Tehran University of Medical Sciences, Tehran, Iran

Farshad Gholipour
Urology Research Center, Tehran University of Medical Sciences, Tehran, Iran

Seyed Mohammad Kazem Aghamir*
Urology Research Center, Tehran University of Medical Sciences, Tehran, Iran
Email mkahamir@yahoo.com

** Corresponding author*

INTRODUCTION

Indwelling ureteral stents are a commonly used tool in urologic practices. Zimskind et al.[1] described ureteral stent placement for the first time in 1967. However, despite the documented benefits of double-J stents in preventing ureteral obstruction after urologic procedures[2], patients may experience stent-related symptoms and some morbidities, including urinary symptoms, stent-related body pain and sexual difficulties which, together, can severely influence the patients' quality of life and general health substantially[3-8].

Authors have hypothesised several aetiologies responsible for stent-related complications such as bladder trigone irritation and renal reflux[7,9]. Through the years, manufacturers have made innovations in stent design and materials in order to improve stent-caused problems[10,11], yet have failed to design an ideal stent which can significantly reduce adverse effects[11,12].

Given the effect of α-blockers in alleviating lower urinary tract symptoms associated with overactive bladder and benign prostate hyperplasia[13], several studies investigated the role of these agents on stent-related symptoms using the Ureteral Stent Symptom Questionnaire (USSQ)[13-17], the International Prostate Symptom Score (IPSS)[17-24], the Visual Analog Pain Score (VAPS)[19-21,24], or evaluation of clinical symptoms by interviewing the patients[25].

Tamsulosin selectively blocks α-1a/1d adrenergic receptors in smooth muscles of distal ureter, bladder trigone, bladder neck and prostate[26]. Smooth muscle relaxation is believed to reduce bladder, neck and urethral resistance, which can improve stent-related lower urinary tract symptoms[17,18]. The purpose of this clinical trial was therefore to evaluate the effectiveness of tamsulosin in reducing double-J stent-related symptoms in patients undergoing ureteral stenting.

METHODS AND MATERIALS

After ethics committee approval, this prospective double-blinded and placebo controlled randomised clinical trial was carried out between June 2014 and July 2015 in Sina Hospital, Tehran, Iran. The current trial was registered at www.clinicaltrials.gov as IRCT2015042221886N2.

Study population and design

Patients who underwent a double-J ureteral stenting by a single surgeon were assessed for eligibility. Stents were routinely placed before extracorporeal shock wave lithotripsy (ESWL) or following percutaneous nephrolithotomy (PCNL), ureterorenoscopy (URS), endoscopic endopyelotomy, or transureteral ureterolithotomy (TUL) for 4 weeks. Patients with at least 18 years of age and with an unilateral double-J ureteral stent were enrolled into the study after obtaining informed consent about random allocation of treatment and potential side effects of tamsulosin. The exclusion criteria included patients younger than 18 years, pregnant women, patients with bilateral stents, forgotten ureteral stent, long-standing ureteral stent placement, benign prostatic hyperplasia, previous prostatic resection, prostatitis, prostate cancer, bladder neoplasms, recent or recurrent urinary tract infection, history of chronic flank pain, patients previously treated with selective α-blockers, patients with severe cardiovascular disease, and patients affected by risk factors for erectile dysfunction.

Study procedure

Out of 110 patients who were assessed for eligibility, a total of 76 patients (47 men and 29 women, aged 20–74 years) who gave consent were enrolled in the study. Patients were randomly allocated into two groups using a computer randomisation program. In group A, the case group, 38 patients (25 men and 13 women) received a daily 0.4 mg dose of tamsulosin (Maxulosin®, Exir Pharmaceutical Co., Borujerd, Iran). In group B, the control group, 38 patients (25 men and 13 women) received a placebo once a day for 4 weeks. The patients were given numbered containers enclosing unnamed pills. Both participants and physicians were kept blinded to the medication being prescribed.

Before the scheduled operative procedure, routine laboratory tests and imaging were performed. In all patients, an identical flexible double-J ureteral stent was used, although the length and size of stents were individualised for each patient. Stent placement was done under regional or general anaesthesia. The coiled distal end of the stent was the only part of the stent presented in the bladder. Plain abdominal X-ray film was used to assure correct stent positioning. To standardise analgesic consumption, acetaminophen 500 mg was prescribed for pain control. No procedure-related complication occurred. All study procedures were in accordance with the ethical standards of the ethics committee of Tehran University of Medical Sciences on human experimentation and with the Helsinki Declaration of 1975, as revised in 2009.

Patient assessment and outcome measurements

Four weeks after stent placement, patients were interviewed by the same physician about stent-related symptoms including suprapubic pain (filling and voiding phase), haematuria, urinary incontinence, urinary frequency, dysuria, urinary urgency, nocturia, flank pain (filling and voiding phase), genitalia pain, and flank, suprapubic or genitalia pain during sexual activity. Patients were asked to answer the questions regarding the frequency of each symptom in a five-level Likert scale – 'never', 'rarely', 'sometimes', 'often', and 'very often'.

Statistical analysis

Statistical analysis was performed using SPSS ver. 20.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were obtained for each study variable. Chi-square, and student's t-test were used for comparison between the two groups as appropriate; values of p less than 0.05 were considered statistically significant.

RESULTS

Out of 76 enrolled patients, 70 (92.1%) completed the study. Therapies were well tolerated and no patients had to terminate medication owing to adverse effects, and none underwent stent removal prior to the due date. Characteristics of the study population are presented in Table 1. Group A (35 patients) consisted of 22 men and 13 women (mean age 43.0 ± 12.2 years), and group B consisted of 25 men and 10 women (mean age 42.0 ± 12.4 years). A total of 45 patients (64.2%) underwent transurethral lithotripsy, nine patients (12.8%) underwent percutaneous nephrolithotripsy or ESWL, while endopyelotomy for ureteropelvic junction stricture was performed in 16 patients (22.8%). No statistically significant differences were found regarding gender, age, weight, height, nor indication of stent placement between the case and control groups.

Scores 0 to 4 were attributed respectively to the frequency of scale of symptoms stated by patients, with 0 representing 'never' and 4 representing 'very often'. Table 2 summarises the overall results of our study. Student's t-test was used to examine the differences of means between groups. As shown in the table, patients receiving tamsulosin expressed higher scores (1.51 ± 1.66) for nocturia than patients in the control group (0.80 ± 1.07) (p=0.037). The mean score for pain in

Table 1. Patient characteristics in the two groups.

	Group A: Tamsulosin	Group B: Placebo	p value
No. of patients	35	35	NA
Male:Female	22:13	25:10	0.58 [Chi-square]
Age (years) ± SD	43.0 ± 12.2	42.0 ± 12.4	0.72 [Student's t test]
Weight (kg) ± SD	71.6 ± 15.1	70.6 ± 15.3	0.78 [Student's t test]
Height (cm) ± SD	167.5 ± 8.1	166.6 ± 9.7	0.66 [Student's t test]
Indication of stent placement			0.18 [Chi-square]
TUL	20	25	
PCNL/ESWL	7	2	
Endoscopic endopyelotomy	8	8	

the flank, suprapubic and genital areas during sexual activity was lower in patients receiving tamsulosin in comparison to patients receiving the placebo (p values=0.047, 0.041 and 0.047, respectively). Patients treated with tamsulosin showed lower suprapubic pain in filling phase scores (0.49 ± 0.70) than the control group (0.94 ± 1.11) (p=0.043). The mean urinary urgency score was 0.6 in group 1 and 1.1 in the placebo group (p=0.030). No statistically significant differences were found between the two groups concerning haematuria, urinary incontinence, frequency, dysuria, nor overall pain score (p values >0.05).

DISCUSSION

The results of this double-blind, randomised, placebo-controlled study showed that tamsulosin is effective in relieving stent-related symptoms specially in alleviating pain during sexual activity.

Current indications for ureteral stents in urgent conditions include unbearable acute renal colic, obstructive pyelonephritis and renal failure secondary to ureteral obstruction[3]. Endoscopic procedures can be followed by stent placement as a safety measure[27] in several situations, including ureteral oedema, ureteral perforation, solitary kidney, transplant kidney and history of renal failure. There are also relative indications for indwelling ureteral stents such as passive dilation of ureteral orifice and ureter, before ESWL in stones larger than 2 cm, long-lasting impacted stone, endoscopic procedures lasting over 45 minutes, and pregnancy[2,7].

However, despite widespread use of indwelling ureteral stents, there is considerable controversy over the necessity of stent placement after uncomplicated ureteroscopic lithotripsy[28]. Even after choosing the correct stent size and proper placement, indwelling ureteral stents are associated with inevitable morbidities in over 80% of patients[29], including urinary symptoms, haematuria, pain and sexual difficulties which all lead to reduced health-related quality of life[6]. Some researchers report that the position and completeness of the stent's lower loop and proper attention to detail throughout stent placement have an effect on symptom severity[30,31]. For example, an ureteral stent was better tolerated after periureteral injection of botulinum toxin type A after stent placement by significantly decreasing pain and narcotic requirement[32].

However, the exact pathophysiology of stent-related symptoms is not fully understood. It is assumed that lower ureteral smooth muscle spasms, involuntary bladder contraction triggered by neuronal-rich trigone irritation, and urine reflux to the kidneys due to increased bladder outlet resistance are responsible factors[11,14,15,21,33]. α-blockers are recommended as expulsive therapy for ureteral stones and to decrease recurrent colic episodes. They are believed to relieve stent-related morbidity by different ways[34-36]. Blocking α-adrenergic receptors reduces muscle tone of prostatic urethra, bladder trigone and ureter which leads to decreased bladder outlet resistance, voiding pressure, and urinary reflux[17]. However, the effectiveness of these medications and proper therapeutic protocols for alleviation of stent-related symptoms are yet to be discovered by further investigations. Results of the current study showed that tamsulosin (a selective α_{1A} antagonist) can control several stent-related morbidities.

The effectiveness of α-blockers in relieving stent-related symptoms has been investigated by several studies, including patients receiving either alfuzosin 10 mg[13,14,16,25,37], tamsulosin 0.4 mg[15,17,22,23,17], tamsulosin 0.2 mg[19,20], terazosin 4 mg[21,38], terazosin 2 mg[21], or a placebo for 1–6 weeks' treatment. Damiano et al.[15] released the first report of the benefits of a daily dose of tamsulosin 0.4 mg in a prospective study comparing tamsulosin to placebo in 75 patients using the USSQ. Although this study was not double-blinded nor

Table 2. Comparison of symptom frequency scores in the two groups.

	Group A: Tamsulosin	Group B: Placebo	Difference (p value)
Suprapubic pain (filling phase)	0.49 ± 0.70	0.94 ± 1.11	**0.043**
Suprapubic pain (voiding phase)	0.57 ± 0.69	0.94 ± 1.30	0.142
Flank pain (filling phase)	0.97 ± 1.27	1.29 ± 1.31	0.314
Flank pain (voiding phase)	0.83 ± 1.12	0.94 ± 1.25	0.690
Genital pain	0.91 ± 1.29	0.83 ± 1.17	0.772
Flank pain during sexual activity	0.03 ± 0.16	0.17 ± 0.38	**0.047**
Suprapubic pain during sexual activity	0.06 ± 0.23	0.23 ± 0.42	**0.041**
Genitalia pain during sexual activity	0.03 ± 0.16	0.20 ± 0.47	**0.047**
Overall pain score	0.48 ± 0.45	0.69 ± 0.68	0.140
Haematuria	1.20 ± 1.13	1.77 ± 1.16	**0.041**
Urinary incontinence	0.37 ± 0.87	0.31 ± 0.53	0.743
Urinary frequency	2.60 ± 1.55	2.49 ± 1.46	0.753
Dysuria	1.63 ± 1.43	1.74 ± 1.44	0.741
Urinary urgency	0.60 ± 1.73	1.17 ± 1.33	**0.030**
Nocturia	1.51 ± 1.66	0.80 ± 1.07	**0.037**

placebo-controlled, the authors found that patients receiving tamsulosin had their general health better preserved. In another study performed by Wang et al.[17] on 154 patients using the same measurement tool, those receiving tamsulosin showed lower stent-related symptoms and better quality of life than patients receiving a placebo.

Using both IPSS and VAPS, the effect of lower dose of tamsulosin (0.2 mg once a day) alone and in combination with tolterodin or solifenacin on stent-related symptoms was investigated by Lee et al.[19] and Lim et al.[20], respectively. Lee et al. found that only the storage symptom scores were significantly lower in patients receiving either mono- or combination therapy than patients treated with no medication. The author stated that correct placement of the stent is therefore more important than medication in reducing stent-related storage symptoms[19]. Conversely, Lim showed that combination therapy with tamsulosin and solifenacin can better improve both irritative and obstructive symptoms than tamsulosin alone or compared to receiving no medication[20]; the results were later confirmed by Shalaby et al.[23]. Further, improvement of stent-related symptoms by α-blockers was found to be independent to the type of α-blocker, as showed by Dellis et al.[37] comparing tamsulosin and alfuzosin. To the best of our knowledge, there is only one study[18] on α-blocker (doxazosin) ineffectiveness in reducing stent-related symptoms.

In a recent meta-analysis performed by Lamb et al.[35] including 461 patients from five studies, all studies showed a reduction in the USSQ urinary symptom score and body pain scores in patients receiving either tamsulosin or alfuzosin. However, general health and sexual matters improvement were not statistically significant. Results of a further 12 studies including a total number of 946 patients' data were meta-analysed by Yakoubi et al.[36]. Analyses showed a significant reduction in urinary symptoms and pain scores as well as general health improvement in patients receiving α-blockers.

In our study, the reduction in pain scores in patients treated with tamsulosin was more evident when compared to during sexual activity in all three areas – flank, genital and suprapubic. Ureteral stents were showed to impair the quality of sexual life in both men and women[8]. Erectile dysfunction was indicated as the main source of sexual distress in men, probably related to lower urinary tract symptoms and stent permanence. In women, sexuality can be severely impaired as a result of stent-related psychological distresses[8].

We also found tamsulosin effective in reducing haematuria and urinary urgency, although, patients treated with tamsulosin had increased rate of nocturia than patients receiving placebo. Nocturia has not reported as an adverse effect of tamsulosin previously, so this finding should be investigated by larger-scale studies. Koseoglu et al.[39] found tamsulosin ineffective in reducing nocturia in patients being treated for benign prostatic hyperplasia. In another study, combination of α-blockers with zolpidem was shown to better reduce nocturia than α-blockers alone[40].

Our study had several limitations. First, our sample size was statistically small in order to detect small differences between two groups. Second, some patients did not complete the study. Third, we utilised clinical interviews with the patients to evaluate urinary symptoms, whereas Joshi et al.[6] has developed a specific tool for assessing stent-related symptoms called the USSQ. Fourth, the quantity of the analgesics used by patients was not reliably reported. Finally, we did not investigate any adverse effects made by α-blocker use, although therapies were well tolerated and no patients had to discontinue medication owing to side effects. Therefore, further large-scale, randomised, prospective studies are needed to obtain more accurate information.

CONCLUSION

The use of tamsulosin 0.4 mg once daily in patients with unilateral ureteral stenting significantly improved stent-related urinary symptoms, especially the body pain during sexual activity. Therefore, tamsulosin should be considered for patients who complain of stent-related symptoms. In the future, large-scale, prospective and randomised studies will be needed.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Patient consent was undertaken before surgery based on the ethical code of the Tehran University of Medical Sciences Ethics Committee. This trial was registered at www.clinicaltrials.gov as IRCT2015042221886N2. The information is published without the name of the patients. Information, data and photos can be provided if requested.

COMPETING INTERESTS

All authors claim that there is not any potential competing or conflict of interest.

FUNDING

None.

ACKNOWLEDGEMENTS

Special thanks to the Urology Research Center, Tehran University of Medical Sciences.

REFERENCES

1. Zimskind PD, Fetter TR, Wilkerson JL. Clinical use of long-term indwelling silicone rubber ureteral splints inserted cystoscopically. J Urol 1967;97(5):840–844.
2. Knudsen BE, Beiko DT, Denstedt JD. Stenting after ureteroscopy: pros and cons. Urol Clin North Am 2004;31(1):173–180.
3. Chew BH, Knudsen BE, Denstedt JD. The use of stents in contemporary urology. Curr Opin Urol 2004;14(2):111–115.
4. Damiano R, Oliva A, Esposito C, De Sio M, Autorino R, D'Armiento M. Early and late complications of double pigtail ureteral stent. Urologia Int 2002;69(2):136–140.
5. Haleblian G, Kijvikai K, de la Rosette J, Preminger G. Ureteral stenting and urinary stone management: a systematic review. J Urol 2008;179(2):424–430.
6. Joshi H, Newns N, Stainthorpe A, MacDonagh R, Keeley F, Timoney A. Ureteral stent symptom questionnaire: development and validation of a multidimensional quality of life measure. J Urol 2003;169(3):1060–1064.
7. Miyaoka R, Monga M. Ureteral stent discomfort: etiology and management. IJU 2009;25(4):455.
8. Sighinolfi M, Micali S, De Stefani S, Mofferdin A, Grande A, Giacometti, M, et al. Indwelling ureteral stents and sexual health: a prospective, multivariate analysis. J Urol 2007;178(1):229–231.
9. Ecke TH, Bartel P, Hallmann, S, Ruttloff J. Evaluation of symptoms and patients' comfort for JJ-ureteral stents with and without antireflux-membrane valve. Urol 2010;75(1):212–216.
10. Lingeman JE, Preminger GM, Goldfischer ER, Krambeck AE, Team CS. Assessing the impact of ureteral stent design on patient comfort. J Urol 2009;181(6):2581–2587.
11. Thomas R. Indwelling ureteral stents: impact of material and shape on patient comfort. J Endourol 1993;7(2):137–140.
12. Candela J, Bellman G. Ureteral stents: impact of diameter and composition on patient symptoms. J Endourol 1997;11(1):45.
13. Park SC, Jung SW, Lee JW, Rim JS. The effects of tolterodine extended release and alfuzosin for the treatment of double-J stent-related symptoms. J Endourol 2009;23(11):1913–1917.
14. Beddingfield R, Pedro RN, Hinck B, Kreidberg C, Feia K, Monga M. Alfuzosin to relieve ureteral stent discomfort: a prospective, randomized, placebo controlled study. J Urol 2009;181(1):170–176.
15. Damiano R, Autorino R, De Sio M, Giacobbe A, Palumbo IM, D'Armiento M. Effect of tamsulosin in preventing ureteral stent-related morbidity: a prospective study. J Endourol 2008;22(4):651–656.
16. Deliveliotis C, Chrisofos M, Gougousis E, Papatsoris A, Dellis A, Varkarakis IM. Is there a role for alpha1-blockers in treating double-J stent-related symptoms? Urology 2006;67(1):35–39. doi:10.1016/j.urology.2005.07.038
17. Wang C-J, Huang S-W, Chang C-H. Effects of specific α-1A/1D blocker on lower urinary tract symptoms due to double-J stent: a prospectively randomized study. Urol Res 2009;37(3):147–152.
18. Kuyumcuoglu U, Eryildirim B, Tuncer M, Faydaci G, Tarhan F, Ozgül A. Effectiveness of medical treatment in overcoming the ureteral double-J stent related symptoms. Can Urol Assoc J 2012;6(6):e234–237.
19. Lee SJ, Yoo C, Oh CY, Lee YS, Cho, ST, Lee SH, et al. Stent position is more important than α-blockers or anticholinergics for stent-related lower urinary tract symptoms after ureteroscopic ureterolithotomy: a prospective randomized study. Korean J Urol 2010;51(9):636–641.
20. Lim KT, Kim YT, Lee TY, Park SY. Effects of tamsulosin, solifenacin, and combination therapy for the treatment of ureteral stent related discomforts. Korean J Urol 2011;52(7):485–488.
21. Mokhtari G, Shakiba M, Ghodsi S, Farzan A, Heidari Nejad S, Esmaeili S. Effect of terazosin on lower urinary tract symptoms and pain due to double-J stent: a double-blind placebo-controlled randomized clinical trial. Urologia Int 2011;87(1):19–22.
22. Navanimitkul N, Lojanapiwat B. Efficacy of tamsulosin 0.4 mg/day in relieving double-J stent-related symptoms: a randomized controlled study. J Int Med Res 2010;38(4):1436–1441.
23. Shalaby E, Ahmed A.-f, Maarouf A, Yahia I, Ali M, Ghobish A. Randomized controlled trial to compare the safety and efficacy of tamsulosin, solifenacin, and combination of both in treatment of double-j stent-related lower urinary symptoms. Adv Urol 2013.
24. Wang C-J, Huang S-W, Chang C-H. Effects of tamsulosin on lower urinary tract symptoms due to double-J stent: a prospective study. Urologia Int 2008;83(1):66–69.

25. Nazim SM, Ather MH. Alpha-blockers impact stent-related symptoms: a randomized, double-blind, placebo-controlled trial. J Endourol 2012;26(9):1237–1241.
26. Shibasaki M, Sudoh K, Inagaki O, Uchida W, Honda K. Effect of the optical isomers of YM-12617 on increased intra-urethral pressure induced by phenylephrine in anaesthetized dogs. J Autonom Pharmacol 1992;12(4):263–268.
27. Jeong H, Kwak C, Lee S. Ureteric stenting after ureteroscopy for ureteric stones: a prospective randomized study assessing symptoms and complications. BJU Int 2004;93(7):1032–1034.
28. Nabi G, Cook J, N'Dow J, McClinton S. Outcomes of stenting after uncomplicated ureteroscopy: systematic review and meta-analysis. BMJ 2007;334(7593):572.
29. Joshi H, Stainthorpe A, MacDonagh R, Keeley F, Timoney A. Indwelling ureteral stents: evaluation of symptoms, quality of life and utility. J Urol 2003;169(3):1065–1069.
30. Jeon SS, Choi YS, Hong JH. Determination of ideal stent length for endourologic surgery. J Endourol 2007;21(8):906–910.
31. Rane A, Saleemi A, Cahill D, Sriprasad S, Shrotri N, Tiptaft R. Have stent-related symptoms anything to do with placement technique? J Endourol 2001;15(7):741–745.
32. Gupta M, Patel T, Xavier K, Maruffo F, Lehman D, Walsh R, Landman J. Prospective randomized evaluation of periureteral botulinum toxin type A injection for ureteral stent pain reduction. J Urol 2010;183(2):598–602.
33. Duvdevani M, Chew BH, Denstedt JD. Minimizing symptoms in patients with ureteric stents. Curr Opin Urol 2006;16(2):77–82.
34. Dellis A, Joshi HB, Timoney AG, Keeley FX. Relief of stent related symptoms: review of engineering and pharmacological solutions. J Urol 2010;184(4):1267–1272.
35. Lamb AD, Vowler SL, Johnston R, Dunn N, Wiseman OJ. Meta-analysis showing the beneficial effect of α-blockers on ureteric stent discomfort. BJU Int 2011;108(11):1894–1902.
36. Yakoubi R, Lemdani M, Monga M, Villers A, Koenig P. Is there a role for α-blockers in ureteral stent related symptoms? A systematic review and meta-analysis. J Urol 2011;186(3):928–934.
37. Dellis AE, Keeley FX, Manolas V, Skolarikos AA. Role of α-blockers in the treatment of stent-related symptoms: a prospective randomized control study. Urol 2014;83(1):56–62.
38. Tehranchi A, Rezaei Y, Khalkhali H, Rezaei M. Effects of terazosin and tolterodine on ureteral stent related symptoms: a double-blind placebo-controlled randomized clinical trial. Int Braz J Urol 2013;39(6):832–840.
39. Koseoglu H, Aslan G, Ozdemir I, Esen A. Nocturnal polyuria in patients with lower urinary tract symptoms and response to alpha-blocker therapy. Urol 2006;67(6):1188–1192.
40. Song YS, Ku JH. Zolpidem pharmacotherapy combined with alpha-blocker therapy for nocturia unresponsive to alpha-blocker monotherapy in men with lower urinary tract symptoms: a preliminary study. Int Urol Nephrol 2007;39(4):1147–1152.